

CET431-101	AGGREGATE TESTING LAB
CONSTRUCTION TESTING	PROFESSOR WASHINGTON
NAME OF GROUP	IDEAL TESTING LABS
GRADING ITEMS	COMMENTS
COOPERATIVE LEARNING	ALL MEMBERS OF THE GROUP SEEM TO WORK VERY WELL, WITH MONOR EXCEPTIONS.
ESSAY QUESTIONS	GOOD JOB WITH ESSAY QUESTIONS - YOU SEEM TO HAVE A VERY GOOD HANDLE ON WHAT THE OBJECTIVES OF THE LAB. IT WAS APPRECIATED THAT FOR EACH EXPERIMENT YOU WERE ABLE TO DEMONSTRATE CRITICAL THINKING AS TO WHAT DIFFICULTIES YOU EXPERIENCED. YOUR RESULTS SUGGESTED THAT THE REPEATABILITY OF LABS VERY NECESSARY IN OPOSE TO WHAT YOU STATED IN DISCUSSION QUESTION #1 IN ORDER TO GIVE YOU MORE INSIGHT AS TO WHAT WAS GOING ON. SEE COMMENTS ON LAB FOR ERRORS AND OMISSIONS. YOUR RESULTS WERE TABULATED AS INSTRUCTED IN THE CLASS FOR THE CONCRETE MIX DESIGN. THANK YOU!
VIDEO QUESTIONS.	VIDEO QUESTIONS WERE COMPLETED WELL WITH A FEW MISTAKES AS NOTED
LAB CALCULATIONS	NOT VERY GOOD ON THE CALCULATION FOR THE LAB. MUCH OF THE WORK OR CALCULATIONS SEEMED TO BE MISSING MOSTLY IN THE SIEVE CALCULATIONS. AIR DRY CALCULATION WAS NOT PERFORMED FOR LAB #1 IN ORDER TO OBTAIN THE CORRECT SPECIFIC GRAVITY WHICH MOST GROUPS DID NOT DEMONSTRATE.
FINAL LETTER GRADE	B

AGGREGATE TESTING LAB

NAME OF GROUP:

Ideal Testing Labs



LIST OF OTHERS IN YOUR GROUP:

PETER CECKO
VALERIE LOPEZ
ROB SGOBBO
JOHN WESLEY
HILLARY ZAENCHIK (CAPTAIN)
SASA ZONIE



A. Essay Questions

I. Objective and Introductory Questions

(Try to answer these questions before performing the test)

1. What is the overall objective of this lab? What will be done with the results of these tests?

- The overall objective of this lab is for each student to be acquainted with the testing procedures for coarse and fine aggregate as well as the ability to determine if the materials required to produce a test sample of concrete are acceptable in standards. This process also affords each student to be acquainted with ASTM sampling and testing procedure for coarse and fine aggregate. As a result, the tests that are performed consequently prepare the lab group in their approach of how the group will proceed in their design of concrete mix.

2. Why is there a need for doing this type of test? How important are these test?

- The need for these types of tests are to acquire the necessary aggregates used to perform in our lab test for concrete mix. These tests are important to achieve the highest possible standard of quality control for quarries.

3. What is the difference between acceptance and quality control? Which one of these applies to the lab work that is being performed?

- Acceptance is the inspection and test performed to determine whether or not a material or product meets specific requirement in order to decide whether or not to accept or reject the material or product.
- Quality control is the inspection and tests performed periodically on selected samples to ensure that the product is acceptable.

II. Narrative Questions

(Try to answer these questions during or after performing the test)

1. Mention any variations in the method that was used in the lab when compared to the specification. (i.e. sample was not immersed 24 hrs)

- For the labs #1 and #2 we did not have sample previously immersed in water for 24+/- 4hrs. For the labs 5 and 6 we did not dry sample in the oven for 24 hrs. Samples used contained some moisture prior to testing.
- Also for lab #1 a variation in towel drying would also play a factor due to the towels being damp (less absorption) utilized by prior lab groups as well as leftover particles within the towel by previous groups.
- The fine aggregate in Lab #2 also has variations due to the drying process in utilizing a hair dryer; thus, losing certain sand particles.

2. If the test method used in the lab varied from the specification, how will it effect the results? (i.e. absorption value would be less if voids were only partially filled with water)

- We believe our absorption results were off due to the fact ^{that the} sample was not fully saturated for 24 hrs. Also, since we did not ^{use} dried sample for labs #5 and #6 the weight of dried sample was actually ^{the} weight of sample with % of moisture in it.

3. What factors contributed to possible errors in your results?

- Unprepared sample, scale accuracy, and not following test specifications 100% are factors that may have contributed to lab errors.
- Lack of group control such as cleaning after one lab station when done.
- Lack of clean towels.
- Oven dry aggregates can have errors due to constant disturbance of opening and shutting the door of the oven. It should be kept under lockdown for the 24 hour period (in our case a week).

4. How do you verify your results and show some consistency? Can your results be verified?

- We followed most of the specifications for each lab to be able to link and verify our results. Every result and value is properly recorded and can be used for verification. Also there are some theoretical values that we know we should expect (e.g. Absorption) and if any huge variation from expected results was observed we would repeat the lab.

*mentoring
repeatability is
important*

III. Discussion Questions

1. Did you repeat some of these tests? Explain.

- NO. Under time constraint as well as lab station constraints. For the time being, the lab was not repeated. However, if this was a controlled experiment and precision was expected then, many, if not most, of the lab experiment would have been redone.

2. How will these results be useful in making concrete?

- The result of each lab in accordance to its specific ASTM specifications will prepare and enable our group to utilize the necessary materials for our our concrete mix design. These tests are needed to ensure that an acceptable quality concrete product is produced. This means that the concrete product will perform as needed and as defined in the design specifications. For example, to ensure that the desired compressive strength is obtained.

*What about
your results?
They could have
be corrected or
Ver. fixed!*

O.K

2. If the test method used in the lab varied from the specification, how will it effect the results? (i.e. absorption value would be less if voids were only partially filled with water)

- We believe our absorption results were off due to the fact ^{that the} sample was not fully saturated for 24 hrs. Also, since we did not ^{use} dried sample for labs #5 and #6 the weight of dried sample was actually ^{the} weight of sample with % of moisture in it.

3. What factors contributed to possible errors in your results?

- Unprepared sample, scale accuracy, and not following test specifications 100% are factors that may have contributed to lab errors.
- Lack of group control such as cleaning after one lab station when done.
- Lack of clean towels.
- Oven dry aggregates can have errors due to constant disturbance of opening and shutting the door of the oven. It should be kept under lockdown for the 24 hour period (in our case a week).

4. How do you verify your results and show some consistency? Can your results be verified?

- We followed most of the specifications for each lab to be able to link and verify our results. Every result and value is properly recorded and can be used for verification. Also there are some theoretical values that we know we should expect (e.g. Absorption) and if any huge variation from expected results was observed we would repeat the lab.

III. Discussion Questions

1. Did you repeat some of these tests? Explain.

- NO. Under time constraint as well as lab station constraints. For the time being, the lab was not repeated. However, if this was a controlled experiment and precision was expected then, many, if not most, of the lab experiment would have been redone.

2. How will these results be useful in making concrete?

- The result of each lab in accordance to its specific ASTM specifications will prepare and enable our group to utilize the necessary materials for our concrete mix design. These tests are needed to ensure that an acceptable quality concrete product is produced. This means that the concrete product will perform as needed and as defined in the design specifications. For example, to ensure that the desired compressive strength is obtained.

OK

mentioning
repeatability is
important

What about
our results?
could have
corrected or
re-done?

OK

3.

What was the classification of your aggregate?

- Lab 1 coarse aggregate
- Lab 2 fine grain
- Lab 3 coarse aggregate
- Lab 4 fine
- Lab 5 coarse grain
- Lab 6 fine grain

Stone # 57

4.

Did it meet ASTM specifications or standards?

- Lab 1 coarse aggregate - yes
- Lab 2 fine aggregate -
- Lab 3 coarse aggregate -
- Lab 4 fine and coarse aggregate for ssd yes. Absorption no.
- Lab 5 coarse grain -
- Lab 6 fine grain - Did not meet the acceptance criteria for ASTM C33 fines modules

yes

5. How will the concrete industry benefit from these tests?

- The concrete industry, through tests for acceptance (quality assurance) or control, will benefit through best practices and effective material for the industry's project as well as cost effectiveness and environment impact in the future.

(fines + modulus)

IV. Conclusion Questions

Did you achieve your objective or goal? What factors or parameters that you obtained in this lab, have a direct effect on the performance or the strength of your concrete mix design? Explain.

Never answered

With these test?

Impact involved

How is environmental

FILL IN THE VALUES FOR ALL OF THESE PARAMETERS:

G (CA) for SSD	G (CEMENT)	%ABS (CA)	% TM (CA)	DRW (CA)	G (FA) for SSD	%ABS (FA)	%TM (FA)	FM (FA)
2.77	3.15	11	1.8	104.3	2.85	1.66	0.11	0.27

Too high

See the range in ASTM C33

Be Fine 0.27

How can Modulus

B. Video Questions

I. **ASTM C702 Reducing Field Samples of Aggregate to Testing Size**

1. Why was the field sample test method developed?
 - The field sample test method is utilized to minimize variations of large samples obtained in the field in which certain portions of the field samples are used for individual tests. The field sample test method also ensures that the smaller test sample is an accurate representation of the larger sample and total supply.
2. What two factors determine the method to be used in reducing a field sample?
 - (i) Moisture Content
 - (ii) Amount of coarse, mixture and fine aggregates.
3. Name three methods for reducing field samples?
 - (i) Mechanical Splitter
 - (ii) Quartering Technique
 - (iii) Miniature Stockpile Sampling
4. Which method is mandatory for samples of fine aggregate drier than Saturated Surface Dry (SSD)?
 - Mechanical Splitter is mandatory for samples of fine aggregate drier than SSD.
5. What kind of aggregate samples are only used with Miniature Stockpile Sampling?
 - Fine aggregates containing free surface moisture are used with Miniature Stockpile sampling.
6. What kind of aggregate samples are only used with Miniature Stockpile Sampling?
 - Fine aggregate samples with free surface moisture.

II. **ASTM C117 – Material Finer than No. 200 Sieve in Mineral Aggregate by Washing**

1. According to ASTM C33 (Standard Specifications for Concrete Aggregate), what limiting amount by percent weight of the total sample should pass the No. 200 sieve for concrete subject to abrasion? for all other concrete?
 - Limiting amounts by percent weight of the total sample that should pass the No. 200 sieve for concrete subject to abrasion is 3.0%. 5.0% for all others.

2. Should we use the same test sample C117 and C136 for an aggregate with a nominal size of $\frac{1}{2}$ inch or less?

Yes
- No. The same test sample should not be used for C117 and C136.

for nominal size of $\frac{1}{2}$ " or less!

III. ASTM C136 – Sieve Analysis of Fine and Coarse Aggregate

1. When sieving by mechanical apparatus or by hand, how long should sieving continue?

- Sieving should discontinue by mechanical apparatus when not more than 1% of the sample passes through in 1 minute of continuous sieving.

2. What is the fineness modulus?

It finds the avg size of sample!

- Fineness modulus is an empirical number used for the acceptance and control of aggregates for concrete

3. What are the U.S. Standard sieve sizes used to calculate fineness modulus? What is the relationship between each consecutive sieve?

- FM is calculated from the cumulative percentages of aggregate retained on sieves No. 4, 8, 16, 30, 50, 100, $\frac{3}{8}$ in., $\frac{3}{4}$ in., 1.5in., 3in., and 6in., divided by 100.

4. The total weight of the sample after sieving should be within what percent of the total dry weight of sample before sieving?

- The total weight of the sample after sieving should be within .3% of the total dry weight of the sample before sieving.

5. Why is the weight of particles on a given sieve considered "Cumulative"?

- The weight of particles on a given sieve are considered cumulative because all the particles from the previous sieve are retained on that sieve

IV. ASTM C29 – Unit Weight and Voids in Aggregate

1. What should the moisture content of the test sample be at the time of testing?

- The moisture content of the test sample should be oven dried at the time of testing.

2. What minimum capacity unit weight bucket should be used for an aggregate sample with a maximum aggregate size of $\frac{3}{4}$ in?

- $\frac{1}{3}$ cu-ft. A unit weight bucket should be used for an aggregate sample with a maximum aggregate size of $\frac{3}{4}$ inch.

V. ASTM C127 – Specific Gravity and Absorption of Coarse Aggregate

1. Should this method be used to determine the specific gravity and absorption of lightweight stones?
 - No. According to ASTM C127 standard documentation this test method should not be used with lightweight aggregates.
2. Define the term Saturated Surface-Dry (SSD).
 - SSD = the condition of the aggregate due to water penetration of the pores, but with no surface moisture.
3. Define the term absorption.
 - The percentage of the weight of water needed to fill the pores compared to the oven-dry weight of aggregate, is computed by dividing the difference between SSD weight and OD weight in air by the OD weight in air.
4. What difference in calculations are made for Specific Gravity for SSD and Oven Dry stones?
 - For SSD -- Specific Gravity = $\text{SSD mass} / (\text{SSD mass} - \text{Submerged mass})$
 - For OD -- Specific Gravity = $\text{OD mass} / (\text{SSD mass} - \text{Submerged mass})$

VI. ASTM C128 – Specific Gravity and Absorption of Fine Aggregate

1. How does one know when SSD has been reached in a sand sample?
 - Using the cone test, tapping the sample 25x in place then removing the cone from the sample, the sample should slump slightly which will conclude that it has reached SSD. If surface moisture is present, the sample will remain as a similar mold of the cone.
2. What decimal place is recommended for recording all of the weights?
 - The sample should be recorded to the tenth decimal place.

VII. ASTM C566 – Total Moisture of Aggregate by Drying

1. Why is it important when drying a sample with a hot plate or electric heat lamps to avoid hot spots?
 - Hot spots causes uneven drying, thus inaccurate weights. Moreover, care should be taken to avoid excessive localized overheating and fracturing of aggregates. When a hot plate is used, the sample is stirred repeatedly while observing the state of the aggregate. Some types of aggregate will not tolerate the heat and may fracture, despite the best of care.

2. Define the term total moisture content.

- Moisture content is the percentage of water in a sample.

- As a formula – $\text{Weight of water} / \text{Weight of solids}$

3. What is the additional weight loss after further heating, when a sample is considered to be oven dry?

- The burning off of moisture for a prolong period of time.

The organics can be burnt off after additional drying.

.10% of its total weight

C. Lab Procedure Questions and Calculations

I. Lab#1: Specific Gravity and Absorption of Coarse Aggregate (CA) – ASTM C127

Define Specific Gravity, Bulk Specific Gravity, Apparent Specific Gravity, and Absorption.

- **Specific Gravity** – is the ratio of the solid unit weight of that substance to the unit weight of water.
- **Bulk Specific Gravity** – is based on oven-dry weight and saturated, surface-dry volume of the aggregate particles.
- **Apparent Specific Gravity** – is based on oven-dry weight and solid volume of the particles.
- **Absorption** – percentage of the weight of water needed to fill the pores compared to the oven-dry weight of aggregate, is computed by dividing the difference between SSD weight and OD weight in air by the OD weight in air.

Procedure:

Equipment: Balance, wire basket (of 3.35mm or finer wire mesh), water tank, oven

Sample: A minimum of 4000 gm (8.8lb) test sample for aggregate of maximum nominal size 1in (25 mm). The sample should not have particles of sizes less than 0.187 in. (4.75 mm).

<i>Maximum size of CA [in.(mm)]</i>	<i>Minimum Weight of Sample [lb(kg)]</i>
<i>1 (25)</i>	<i>8.8(4)</i>
<i>¾ (19)</i>	<i>6.6(3)</i>
<i>½" or less (12.5)</i>	<i>4.4(2)</i>

- Weigh the test sample: Air (g)*
- Immerse the aggregate in water at room temperature for a period of 24±4h.*
- Remove the sample from the water. Roll it in a large absorbent cloth until all visible films of water are removed. The sample is now in Saturated Surface Dry (SSD) condition.*
- Weigh the sample and obtain its SSD weight: SSD (g)*
- Place the SSD sample in the wire basket and determine its weight in water: SUB(g)*

Note that the wire basket should be immersed to a depth sufficient to cover it and the test sample during weighing.

f. Remove the sample from the wire basket.

g. Dry the sample to constant weight at a temperature of 110±5° C (≈24h.), and weigh: OD(g)

NOTES: Stones are submerged in a pail, so that you do not have to wait 24 hrs., therefore, by knowing the oven dry weight of this sample and finding the total moisture of the stone (lab#4), you can calculate the Air dry Weight (Air).

3. Calculate the following specific gravities and absorption.

Formulas:

Air = 8.8#
SSD = 8.82#
OD = 8.72#
SUB = 5.64#

where is this calculation? should be here!

Bulk Gs (Air Dry) $\frac{\text{Air}}{SSD - SUB} = 8.8\# / 8.82 - 5.64 = 2.76$

Bulk Gs (SSD) $\frac{SSD}{SSD - SUB} = 8.82\# / 8.82\# - 5.64\# = 2.77$

Apparent Gs $\frac{OD}{OD - SUB} = 8.72 / 8.72 - 5.64 = 2.83$

Absorption = $\frac{SSD - OD}{OD} \times 100 = 8.82\# - 8.72 / 8.72 \times 100 = 1.14\%$

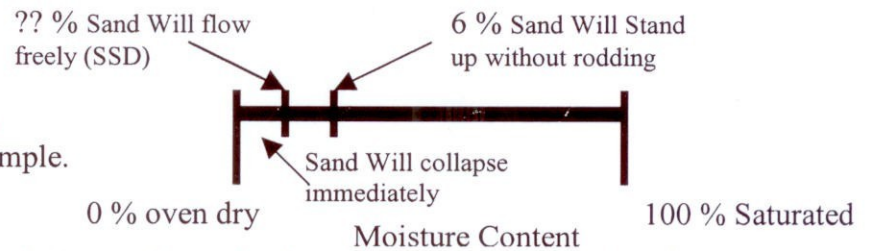
OK

II. Lab#2: Specific Gravity and Absorption of Fine Aggregate (FA) – ASTM C128

Procedure:

Equipment: Balance, pycnometer & oven

Sample: About 500g of fine aggregate sample.



- a. Weigh the test sample: Air (g)
- b. Cover the test sample with water, either by immersion or by the addition of at least 6% moisture to the sample, and permit to stand for 24 ± 4 h.
- c. Decant excess water with care to avoid loss of fines. Spread the sample on a flat nonabsorbent surface exposed to a gently moving current of warm air, and stir frequently to secure homogeneous drying. Continue until the sample approaches a free-flowing condition. Weigh the specimen when it has reached a SSD(g).
- d. Fill the pycnometer with water to the top, and weigh: $PYC(g)$
- e. Remove part of the water, and introduce the SSD sample into the pycnometer.
- f. Fill with additional water to approximately 90% of its capacity.
- g. Roll, invert, and agitate the pycnometer to eliminate all air bubbles.
- h. Bring the water level in the pycnometer to its calibrated capacity.
- i. Determine the total weight of the pycnometer, specimen, and water: $SUB(g)$
- j. Remove the sample from the pycnometer, dry to constant weight at a temperature of $110 \pm 5^\circ C$, cool, and weigh: $OD(g)$

(Lab#2 continued)

Calculate the specific gravity and absorption.

$$\text{Bulk Gs (Air Dry)} = \frac{\text{Air}}{\text{PYC} + \text{SSD} - \text{SUB}} = \frac{396.156\text{g}}{1331.29\text{g} + 556\text{g} - 1686.36\text{g}} = 1.97$$

$$\text{Bulk Gs (SSD)} = \frac{\text{SSD}}{\text{PYC} + \text{SSD} - \text{SUB}} = \frac{556\text{g}}{1331.29\text{g} + 556 - 1686.36} = 2.767$$

$$\text{Apparent Gs} = \frac{\text{OD}}{\text{PYC} + \text{OD} - \text{SUB}} = \frac{546.9\text{g}}{1331.29\text{g} + 546.9\text{g} - 1686.36\text{g}} = 2.85$$

$$\text{Absorption} = \frac{\text{SSD} - \text{OD}}{\text{OD}} \times 100 = \frac{556\text{g} - 546.9\text{g}}{546.9\text{g}} \times 100 = 1.66\%$$

III. Lab#3: Unit Weight and Voids in Aggregate – ASTM C29,C127, C128

Define air voids, unit weight, and bulk density.

Air voids – the amount of air in between and inside the aggregate

Unit weight – the mass of the test sample

Bulk Density – weight of the aggregate, not including the weight of the water.

Procedure:

Equipment: Balance, 5/8 in. diameter tamping rod (24 in. long), cylindrical metal measure (minimum capacity of 1/2 cuft. for CA of size not larger than 1.5 in and of .1 cuft. for FA)

Sample: Aggregate dried to constant weight, preferably in an oven at 110±5° C.

<i>Maximum size of CA [in.(mm)]</i>	<i>Minimum Volume of Sample [ft³]</i>
1 (25)	1/3
1/2" or less (12.5)	1/10

- a. Find the empty weight of the metal measure.
- b. fill the measure with the dry sample one-third full.
- c. Rod the layer of aggregate with 25 strokes. (Do not allow the rod to strike the bottom)
- d. Fill the measure two-thirds full, level, and rod as in step c.
- e. Fill the measure overflowing and rod as in step c.
- f. Level the surface of the aggregate with a finger and tamping rod such that any slight projection of the larger pieces of the CA approximately balance the larger voids in the surface below the top of the measure.
- g. Weigh the measure with the aggregate and find the net weight of the aggregate: WT (lbs)

NOTE: Be sure to measure the dimensions of the bucket to confirm its volume.

(Lab#3 continued)

1. Calculate the unit weight:

$$\text{Unit Weight or Bulk Density or Dry Rodded Unit Weight (DRW)} = \frac{WT}{V},$$

$$104.3 \text{ \#} / 1 \text{ ft}^3 = 104.3 \text{ pcf}$$

where V is the volume of the pail (cu ft.)

2. Calculate the void content or percent void.

$$\text{Void (\%)} = \frac{G S_{(Air Dry)} \times \delta_w - DRW}{G S_{(Air Dry)} \times \delta_w} =$$

$$= [2.76(62.4) - 104.3] / [2.76(62.4)]$$

$$= 67.924 / 172.22 = 0.377$$

$$= 0.377 * 100 = 37.7 \%$$

where δ_w is the unit weight of water (62.4pcf)

IV. Lab#4: Total Moisture Content and Surface Moisture Content of Aggregate- ASTM C566, C127, and C128

Define Moisture Content, Absorption, and Surface Moisture.

- **Moisture Content** – it is the weight of water in the sample expressed as the percentage of the weight of the OD sample.
- **Absorption** – it is the percentage of the weight of water needed to fill the pores compared to the OD weight of the sample.
- **Surface Moisture** – it is free water retained on surface of aggregate particles. Expressed as a percentage by weight of the SSD aggregate.

Procedure:

1. Equipment: Balance, oven

Sample: A minimum of 4000 gm (8.8lb) of CA and 500gm of FA. (Please perform both test)

Maximum size of CA [in.(mm)]	Minimum Weight of Sample [lb(kg)]
1 (25)	8.8(4)
3/4 (19)	6.6(3)
1/2" (12.5)	4.4(2)

- a. Weigh the sample:
- b. Dry the sample to constant weight in an oven at 110±5° C for approximately 24h and cool.
- c. Weigh the dried sample: OD(g)

2. Calculate the moisture content.

FA = Air = 500g + 9.2g (tin) = 509.2g
 OD = 508.6g SSD = 518g

CA = Air = 8.8# + 2.2# (bucket) = 11#
 OD = 10.97# SSD = 13#

Total Moisture

$$\frac{\text{Air} - \text{OD}}{\text{OD}} \times 100 = \frac{509.2\text{g} - 508.6\text{g}}{508.6\text{g}} \times 100 = .11\% \text{ (FA)}$$

$$\frac{\text{Air} - \text{OD}}{\text{OD}} \times 100 = \frac{11\# - 10.97\#}{10.97\#} \times 100 = .27\% \text{ (CA)}$$

Why are these values crossed out?

Air_{FA} = 509.15g

Air_{CA} = 10.99#

Surface Moisture Content = Total Moisture – Absorption =

Absorption $\frac{\text{SSD} - \text{OD}}{\text{OD}} \times 100 = \frac{518\text{g} - 508.6\text{g}}{508.6\text{g}} = 1.80\% \text{ (FA)}$

SMC = ~~0.6%~~ - 1.80% = -74% (FA)

Absorption $\frac{\text{SSD} - \text{OD}}{\text{OD}} \times 100 = \frac{16\# - 10.97\#}{10.97\#} = 46\%$

SMC = ~~1.8%~~ - 46% = -44.2% (CA)

Where is surface moisture calculations?

V. Lab#5: Sieve Analysis of Coarse Aggregate- ASTM C136

[Draw the gradation curve for this sample and include the upper and lower bound limits.]

Procedure:

Equipment: Balance, sieves, mechanical shaker, oven

Sample: Coarse Aggregate of weight equal to:

Maximum size of CA [in.(mm)]	Minimum Weight of Sample [lb(kg)]
1.5 (37.5)	33(15)
1 (25)	22(10)
$\frac{3}{4}$ (19)	11(5)
$\frac{1}{2}$ " (12.5)	4.4(2)

Note : Use the same weight for $\frac{3}{4}$ in. when the maximum size is less than $\frac{3}{4}$ in.

- Dry the sample to constant weight at a temperature of 110° C (230 F) if the sample is lightweight or is suspected of containing appreciable amount s of material finer than a No. 4 sieve.
- Weigh the dry sample accurately.
- Weigh each empty sieve and the pan.
- Nest the suitable sieves in order of decreasing size of opening from top to bottom. Place the pan at the bottom of the set. Sieves: No. 8, No. 4, 3/8 in, 1/2 in, 3/4 in, 1 in, 1 1/2 in (and higher if needed)
- Place the sample on the top sieve.
- Place the lid, and agitate the sieves in the mechanical shaker for about 10 min.
- Weigh the sieves with the material retained.
- Determining the weight retained in each sieve. The total weight of the material after sieving should check closely with the original weight of the sample. If the amount differs by more than 0.3% (based on the original weight) the results should not be used.

- Tabulate the percentage retained ✓
- Tabulate cumulative percentage ✓
- Tabulate percentage passing ✓
- Draw the gradation curve on the sieve graph ✓
- Draw the upper and lower bound ✓
- Find out the ASTM C33 designation ✓
- Calculate the Fineness Modulus
 - Find the average sieve ✓
 - Find the average size stone ✓
 - Determine effective size ✓
 - uniformity coefficient ✓

Not mentioned on graph
→ wrong sieve sizes used in calculation
→ see comments

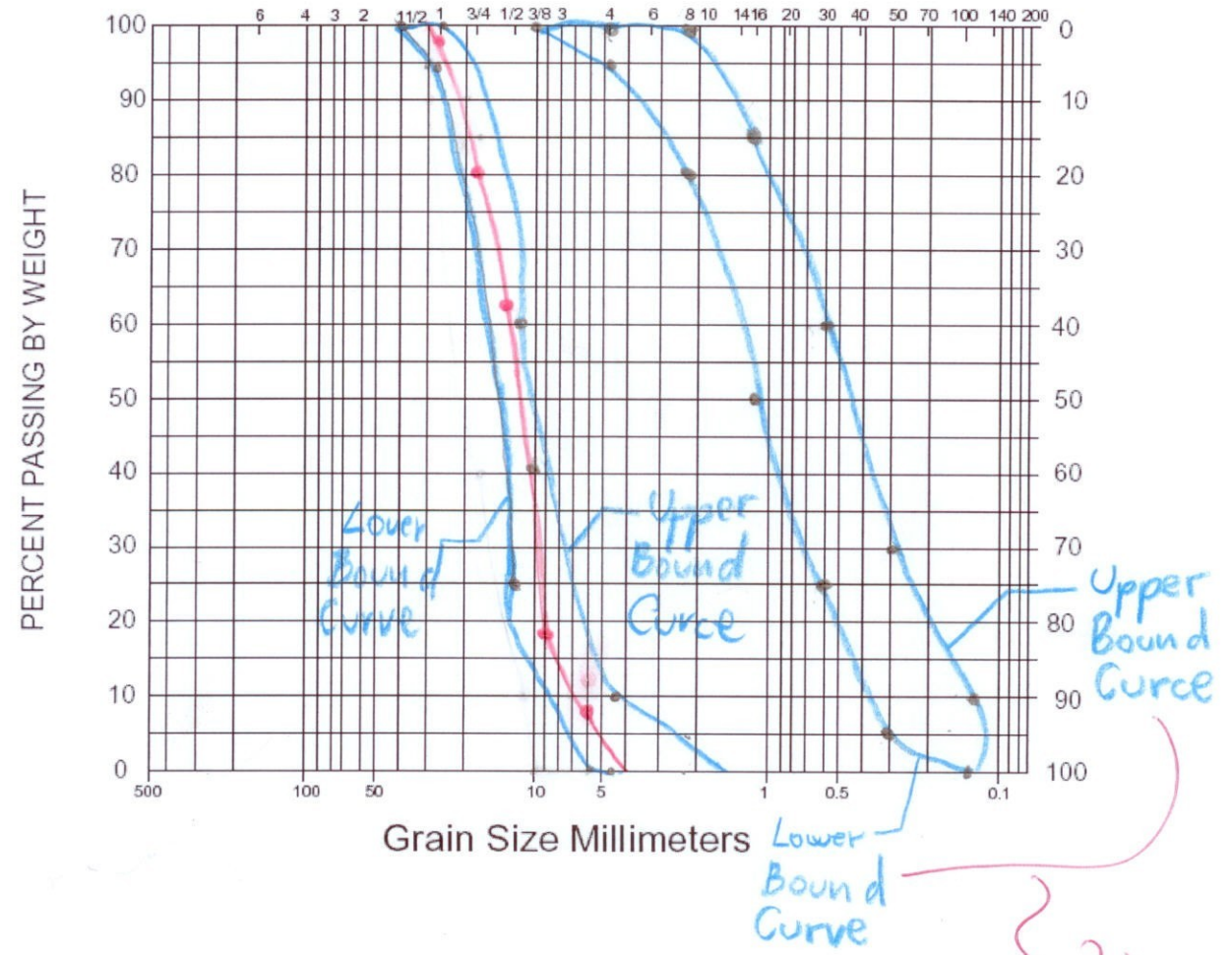
Test #5

Aggregate + bucket = 64.4 lb
 46.3 / 16 19.09 / 16

Emp. Sieve
 ↓

SIEVE	WT. RET.	% RET.	% COARSER	% PASS
16.60# 1" 17.3#	0.71	1.54	1.54	98.46
16.25# 3/4" 24.5#	8.33	18.06	19.6	80.4
16.53# 5/8" 24.24#	7.71	16.72	36.32	63.68
16.5# 3/8" 37.3#	20.74	44.98	81.30	18.7
16.07# 1/4" 19.27#	3.20	6.94	88.24	11.76
14.91# 1/8" 16.72#	1.81	3.92	92.16	7.84
4.14# Pan 17.25#	3.61	7.83	100	0
TOTAL	46.11	100%		

U.S. STANDARD SIEVE SIZES



for what stones?

Lab #5

Fineness Modulus:

1"	1.54
3/4"	19.6
5/8"	36.32
3/8"	81.30
1/4"	88.24
1/8"	92.16
	<u>319.16</u>

$$\frac{319.16}{100} = \boxed{3.19}$$

Must use
 1 1/2"
 3/4"
 3/8"
 #4

Wrong sieves for FM Calculation

Average Sieve Size: $\boxed{3/8''}$

Average Size Stone: # 5/8" = 0.6 in
 # 3/8" = 0.35 in
 $\Delta = 0.25$ in

Average Size = # 3/8" + 0.19 (0.25") = 0.35 + 0.05 = $\boxed{0.40 \text{ in}}$

Uniformity Coefficient:

$$\frac{D_{60}}{D_{10}} = \frac{1/2''}{1/4''} = \boxed{2}$$

Show these parameters on graph

Using Grading Coarse Aggregates Table Size of Stone is within $\boxed{\#57}$

VI. Lab#6: Sieve Analysis of Fine Aggregate- ASTM C136

[Draw the gradation curve for this sample and include the upper and lower bound limits.]

Define Fineness Modulus.

Procedure:

Equipment: Balance, sieves, mechanical shaker, oven

Sample: Fine Aggregate of weight 500g.

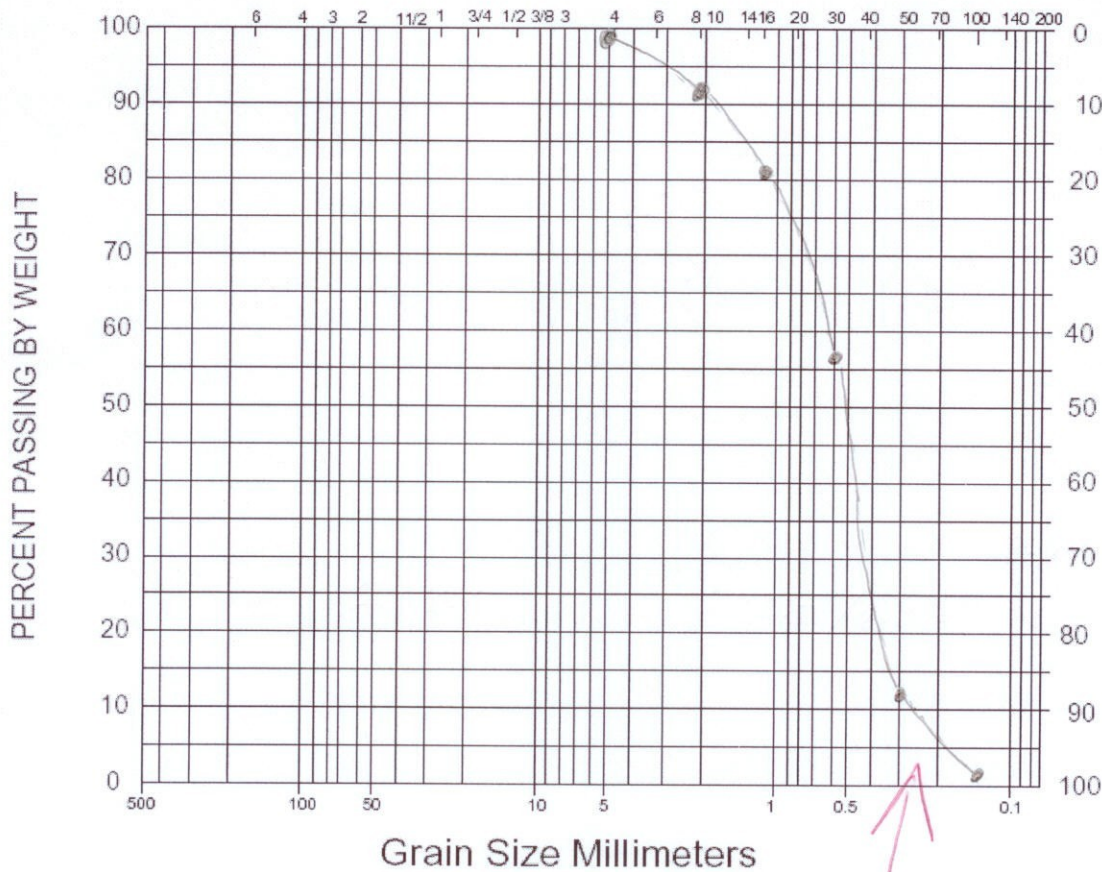
- a. Dry the sample to constant weight at a temperature of 110°C (230 F).
- b. Weigh the dry sample accurately.
- c. Weigh each empty sieve and the pan.
- d. Nest the suitable sieves in order of decreasing size of opening from top to bottom. Place the pan at the bottom of the set. Sieves: No. 100, No. 50, 30, 16, 8, 4
- e. Place the sample on the top sieve.
- f. Place the lid, and agitate the sieves in the mechanical shaker for about 10 min.
- g. Weigh the sieves with the material retained.
- h. Determining the weight retained in each sieve. The total weight of the material after sieving should check closely with the original weight of the sample. If the amount differs by more than 0.3% (based on the original weight) the results should not be used.

- Tabulate the percentage retained
- Tabulate cumulative percentage
- Tabulate percentage passing
- Draw the gradation curve on the sieve graph
- Draw the upper and lower bound
- Find out if this sand meets the ASTM C33 acceptance criteria
- Calculate the Fineness Modulus
 - Find the average sieve
 - Find the average size stone
 - Determine effective size
 - uniformity coefficient

Retained

SIEVE	WT. RET.	% RET.	% COARSER	% PASS
#4	8.1g	1.63	1.6	98.4
#8	28.2g	5.7	7.3	92.7
#16	60.9g	12.3	19.6	80.4
#30	142.7g	28.7	48.3	51.7
#50	196.4g	39.6	87.9	12.1
#100	53.1g	10.7	98.6	1.4
PAN	7.0g	1.4		
TOTAL	496.4	100	263.3	

U.S. STANDARD SIEVE SIZES



Upper & lower bound missing

SIEVE SIZE	CUM PERCENT RETAINED	FM - TOTAL SUMMATION
6"	0	
3"	0	
1.5"	0	
3/4"	0	
3/8"	0	
#4	1.6	1.6
#8	7.3	8.9
#16	19.6	28.5
#30	48.3	76.8
#50	87.9	164.7
#100	98.4	263.3
TOTAL	263.3	543.8 / 100 = 5.44

O.K

↑
 You need this
 for coarse aggregate
 calculations as well!

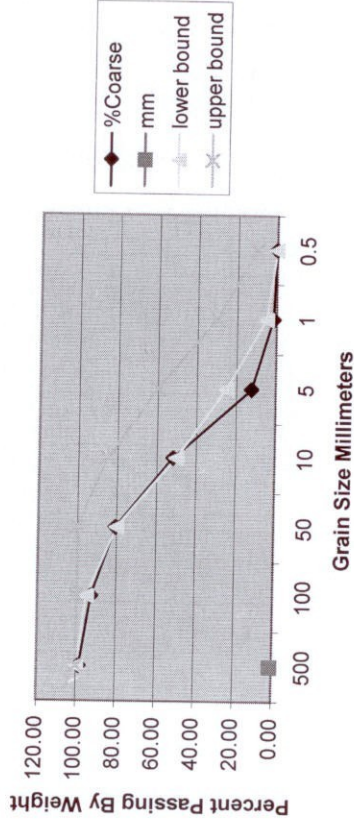
LAB #6

LAB #6

SIEVE	WT. RET.	% RET.	Cum % Total	% COARSER	Grain Size (mm)	sieve	lower	upper
No. 4	8.10	1.63	1.63	98.37	500	3/4	100	100
No. 8	28.20	5.68	7.31	92.69	100	4	95	100
No. 16	60.90	12.27	19.58	80.42	50	8	80	100
No. 30	142.70	28.75	48.33	51.67	10	16	50	85
No. 50	196.40	39.56	87.89	12.11	5	30	25	60
No. 100	53.10	10.70	98.59	1.41	1	50	5	30
PAN	7.00	1.41	1.41	0	0.5	100	0	10
TOTAL	496.40	100.00	264.74		0.1			

SIEVE	Cum % Total	Total Sum FM
6"	0	0
3"	0	0
1.5"	0	0
3/4"	0	0
3/8"	0	0
No. 4	1.63	1.63
No. 8	7.31	8.94
No. 16	19.58	28.52
No. 30	48.33	76.85
No. 50	87.89	164.74
No. 100	98.5	263.24
PAN	1.41	
TOTAL	264.65	543.92

U.S. Standard Sieve Sizes



5.4392 FM

Avg. Sieve Size = 8

Avg. Size = 43%

Eff size
Unit. coeff
Calculations missing!!
What does this mean?
Sizes are in inches or mm.

GROUP NAME:	CAPTAIN NAME:	EMAIL:
LAB#1		
AIR DRY	8.8# = 2.76	9-29
SSD	8.82# = 2.77	
SUB	5.64#	
OD	8.72#	
MC	.92%	
LAB#2		
AIR DRY	396.15556	9-22
SSD	1331.255699 556	
PYC&WATER	1686.361331.299 1331.29	
PYC, WATER,&SSD (SUB)	546.91686.36 1686.36	
OD	546.9	
LAB#3		
VOLUME OF BUCKET	1 ft3	
BUCKET WT.	19.2 #	
STONE WT.	104.3#	
LAB#4		
AIR DRY-SAND	509.2g	
OVEN DRY SAND	508.6g	
MC	.11%	
AIR DRY – C.A.	11#	
OVEN DRY –C.A.	10.97#	
MC	.27%	
LAB#5		
TOTAL WT. STONE	46.31#	9-29
1"	0.71#	
3/4"	8.33#	
1/2"	7.71#	
3/8"	20.74#	
#4	3.20#	
#8	1.81#	
LAB#6	Pan= 3.61#	
TOTAL WT. SAND	796 g	
#4	8.1g	
#8	28.2g	
#16	60.9g	
#30	142.7g	
#50	196.4g	
#100	53.1g	
PAN	7g	

PUT THE DATE NEXT TO EACH WEIGHT THAT WAS TAKEN AND EMAIL!!